

## Claims

1.

A control system for use with a light duty combustion engine, said system comprising:

an input coupled to an engine speed sensor for receiving an electronic speed signal representative of engine speed,

a first output coupled to an ignition device for providing that device with an electronic ignition signal that affects the ignition timing of the engine,

a second output coupled to a valve control device for providing that device with an electronic air/fuel signal that affects the air-to-fuel ratio of a combustible mixture being provided to the engine, and

an electronic processing device coupled to said input for receiving said speed signal, coupled to said first output for providing said ignition signal, and coupled to said second output for providing said air/fuel signal, wherein said processing device is capable of determining said ignition signal and said air/fuel signal according to an independent operating sequence that is capable of being selected by utilizing said speed signal.

2.

A control system as defined in claim 1, wherein said speed signal, a first charge signal for use with the ignition device, a second charge signal for use with the valve control device, and a power signal for supplying power to said electronic processing device are each provided by windings that are operatively coupled to magnetic sections of an engine flywheel.

3.

A control system as defined in claim 2, wherein said ignition signal causes a capacitive discharge of stored energy associated with said first charge signal to a primary ignition winding.

4.

A control system as defined in claim 2, wherein said air/fuel signal causes a capacitive discharge of stored energy associated with said second charge signal to a valve actuating solenoid.

5.

A control system as defined in claim 1, wherein said valve control device is a latching solenoid that controls the air-to-fuel ratio of the combustible mixture by controlling a carburetor air bleed unit.

6.

A control system as defined in claim 1, wherein said electronic processing device is controlled by an independent cranking sequence that is initiated following the starting of the engine and operates for a predetermined number of engine revolutions, and said cranking sequence advances or retards the ignition timing a predetermined number of degrees and controls the air-to-fuel ratio of the combustible mixture.

7.

A control system as defined in claim 6, wherein said cranking sequence follows a predetermined number of 'no-spark' engine revolutions where said electronic processing device does not provide said ignition signal.

8.

A control system as defined in claim 1, wherein said electronic processing device is controlled by an independent warm up sequence that is initiated shortly after the engine is started, said warm up sequence is capable of utilizing said speed signal to advance the ignition timing at a first rate and retard the ignition timing at a second rate, and is capable of enriching the air-to-fuel ratio of the combustible mixture for a first number of engine revolutions and enleaning the combustible mixture for a second number of engine revolutions.

**9.**

A control system as defined in claim 8, wherein said system includes a second input coupled to an engine temperature sensor for receiving an electronic temperature signal representative of engine temperature, and said warm up sequence is capable of controlling the air-to-fuel ratio of the combustible mixture for as long as said temperature signal is less than a predetermined value.

**10.**

A control system as defined in claim 1, wherein said system includes a second input coupled to an engine temperature sensor for receiving an electronic temperature signal representative of engine temperature, and wherein said temperature signal affects said air/fuel signal

**11.**

A control system as defined in claim 10, wherein said independent operating sequence comprises a temperature dependent operating sequence, and wherein said temperature dependent operating sequence is capable of affecting said air/fuel signal as long as said temperature signal is greater than a predetermined value.

**12.**

A control system as defined in claim 10, wherein said independent operating sequence comprises a temperature dependent operating sequence, and wherein said temperature dependent operating sequence is capable of affecting said air/fuel signal for a predetermined number of engine revolutions which is dependent upon said temperature signal.

**13.**

A control system as defined in claim 12, wherein said predetermined number of engine revolutions is determined by a lookup table that utilizes said temperature signal.

**14.**

A control system as defined in claim 12, wherein said temperature dependent operating sequence is capable of detecting cold from hot starts.

**15.**

A control system as defined in claim 12, wherein said temperature dependent operating sequence enriches the combustible mixture if: i) said temperature signal exceeds a predetermined temperature, and ii) said control system has been turned off for less than a predetermined amount of time.

**16.**

A control system as defined in claim 15, wherein said predetermined amount of time is determined by a resistor / capacitor (RC) circuit.

**17.**

A control system as defined in claim 1, wherein said independent operating sequence is an acceleration sequence that is initiated when said speed signal indicates an engine speed acceleration exceeding a predetermined acceleration, said acceleration sequence is capable of advancing the ignition timing a predetermined number of degrees and maintaining said advancement for a predetermined number of engine revolutions, and is capable of enriching the air-to-fuel ratio of the combustible mixture for a predetermined number of engine revolutions.

**18.**

A control system as defined in claim 1, wherein said independent operating sequence is a come down sequence that is initiated when said speed signal indicates that the engine speed has exceeded a predetermined speed followed by a decrease from said predetermined speed, said come down sequence is capable of advancing or retarding the ignition timing a predetermined number of degrees for a predetermined number of engine revolutions, and is capable of enriching the air-to-fuel ratio of the combustible mixture for a predetermined number of engine revolutions.

**19.**

A control system as defined in claim 1, wherein said independent operating sequence is a recovery bump sequence that is initiated when said speed signal indicates that the engine speed is less than a predetermined speed and is capable of

utilizing said speed signal to advance the ignition timing at a first rate and retard the ignition timing at a second rate which is less than said first rate.

**20.**

A method for controlling the ignition timing of a light duty combustion engine, said method comprising the steps of:

- (a) receiving an electronic speed signal representative of engine speed,
- (b) utilizing said speed signal to select from a plurality of independent operating sequences,
- (c) utilizing said selected operating sequence to determine a desired ignition timing value, and
- (d) utilizing said desired ignition timing value to provide an electronic ignition signal to an ignition device, wherein said ignition signal affects the ignition timing of the engine.

**21.**

A method for controlling ignition timing as defined in claim 20, wherein one of said plurality of independent operating sequences includes an acceleration sequence that is initiated when said speed signal indicates an engine speed acceleration exceeding a predetermined acceleration and is capable of advancing the ignition timing a predetermined number of degrees and maintaining the timing at said advanced number of degrees for a predetermined number of engine revolutions.

**22.**

A method for controlling ignition timing as defined in claim 21, wherein said ignition signal is representative of the sum of a first timing value and a second timing value that is determined by said acceleration sequence.

**23.**

A method for controlling ignition timing as defined in claim 22, wherein said control system determines said first timing value by utilizing a look up table relating engine speed to said first timing value.

**24.**

A method for controlling ignition timing as defined in claim 20, wherein one of said plurality of independent operating sequences includes a come down sequence that is initiated when said speed signal indicates that the engine speed has exceeded a predetermined speed followed by a decrease from said predetermined speed, and is capable of advancing or retarding the ignition timing a predetermined number of degrees for a predetermined number of engine revolutions.

**25.**

A method for controlling ignition timing as defined in claim 24, wherein said ignition signal is representative of the sum of a first timing value and a second timing value that is determined by said come down sequence.

**26.**

A method for controlling ignition timing as defined in claim 25, wherein said control system determines said first timing value by utilizing a look up table relating engine speed to said first timing value.

**27.**

A method for controlling ignition timing as defined in claim 20, wherein one of said plurality of independent operating sequences includes a recovery bump sequence that is initiated when said speed signal indicates that the engine speed is less than a predetermined speed and is capable of utilizing said speed signal to advance the ignition timing at a first rate and retard the ignition timing at a second rate which is less than said first rate.

**28.**

A method for controlling ignition timing as defined in claim 27, wherein said ignition signal is representative of the sum of a first timing value and a second timing value that is determined by said recovery bump sequence.

**29.**

A method for controlling ignition timing as defined in claim 28, wherein said control system determines said first timing value by utilizing a look up table relating engine speed to said first timing value.

**30.**

A method for controlling the air-to-fuel ratio of a combustible mixture being provided to a light duty combustion engine, said method comprising the steps of:

- (a) receiving an electronic speed signal representative of engine speed,
- (b) utilizing said speed signal to select from a plurality of independent operating sequences,
- (c) utilizing said selected operating sequence to determine a desired air-to-fuel ratio for the combustible mixture, and
- (d) utilizing said desired air-to-fuel ratio to provide an electronic air/fuel signal to a valve control device, wherein said air/fuel signal affects the air-to-fuel ratio of the combustible mixture being provided to the engine.

**31.**

A method for controlling the air-to-fuel ratio as defined in claim 30, wherein one of said plurality of independent operating sequences includes an acceleration sequence that is initiated when said speed signal indicates an engine speed acceleration exceeding a predetermined acceleration and is capable of enriching the air-to-fuel ratio of the combustible mixture for a predetermined number of engine revolutions.

**32.**

A method for controlling the air-to-fuel ratio as defined in claim 30, wherein one of said plurality of independent operating sequences includes a come down sequence that is initiated when said speed signal indicates that the engine speed has exceeded a predetermined speed followed by a decrease from said predetermined speed, and is capable of enriching the air-to-fuel ratio of the combustible mixture for a predetermined number of engine revolutions.

**33.**

A method for controlling the air-to-fuel ratio as defined in claim 30, wherein step (c) further includes utilizing an engine temperature signal to determine said desired air-to-fuel ratio.

**34.**

A control system for use with a light duty combustion engine, said system comprising:

a speed sensor operatively coupled to the engine and having a signal output for providing an electronic speed signal representative of engine speed,

an ignition switch operatively coupled to a capacitive discharge ignition system and having a signal input for receiving an ignition signal capable of affecting the engine ignition timing,

a first air/fuel mixture switch operatively coupled to a solenoid for driving said solenoid in a first direction for enriching a combustible mixture and having a signal input for receiving a first air/fuel signal,

a second air/fuel mixture switch operatively coupled to said solenoid for driving said solenoid in a second direction for enleaning a combustible mixture and having a signal input for receiving a second air/fuel signal, and

an electronic processing device coupled to said speed sensor output for receiving said speed signal, coupled to said ignition switch input for providing said ignition signal, coupled to said first air/fuel mixture switch for providing said first air/fuel signal, and coupled to said second air/fuel mixture switch for providing said second air/fuel signal, wherein said processing device is capable of determining said ignition signal and said first and second air/fuel signals according to an independent operating sequence that is capable of being selected by utilizing said speed signal.

**35.**

A control system for controlling both ignition timing and air-to-fuel ratio aspects of a light duty combustion engine, said system comprising:

an input capable of receiving a speed signal representative of engine speed,

an ignition timing output coupled to an ignition device for providing that device with an electronic ignition signal that affects the ignition timing of the engine,

an air-to-fuel ratio output coupled to an electronic valve control device for providing that device with an air/fuel signal that affects the air-to-fuel ratio of a combustible mixture being provided to the engine, and

an electronic processing device that is coupled to said input for receiving said speed signal, coupled to said ignition timing output for providing said ignition signal, and coupled to said air-to-fuel ratio output for providing said air/fuel signal, wherein said processing device is capable of utilizing said speed signal or calculations derived from said speed signal to make a selection between one of several independent operating sequences, wherein said independent operating sequences at least include an acceleration sequence.

36.

A control system as defined in claim 34, wherein said system further includes a second input capable of receiving a temperature signal representative of engine temperature, said electronic processing device utilizes said temperature signal when determining said air/fuel signal.

37.

A control system for use with a light duty combustion engine, said system comprising:

a first input coupled to an engine speed sensor for receiving an electronic speed signal representative of engine speed,

a second input coupled to an engine temperature sensor for receiving an electronic temperature signal representative of engine temperature,

an output coupled to a valve control device for providing that device with an electronic air/fuel signal that affects the air-to-fuel ratio of a combustible mixture being provided to the engine, and

an electronic processing device coupled to said first input for receiving said speed signal, coupled to said second input for receiving said temperature signal, and coupled to said output for providing said air/fuel signal, wherein

said processing device is capable of utilizing said speed signal and said temperature signal to determine said air/fuel signal.